

# NASA TECH BRIEF



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## Advances in Aluminum Anodizing

Three aluminum alloys, 2014, 2219 and 7006, were considered in the development of techniques for applying white anodize to aluminum alloy surfaces. The techniques developed have resulted in alloys with good reflectance values and excellent corrosive resistance.

### The problem:

To develop a white anodize for the aluminum surface of a space vehicle that would have the surface reflectance equivalent to the white enameled surface now in use, would meet high corrosive resistance requirements and would result in a weight reduction over previous methods.

### The solution:

The application of white anodize to aluminum alloy surfaces can be considered in four parts: surface preparation, anodizing process, pigmentation and sealing.

1. *Surface preparation.* A method of mechanical and chemical pre-treatment of the aluminum surface was developed to obtain a surface reflectance of 82–86 percent. The treatment consists of cleaning, chemical etching, abrasive blasting with aluminum oxide, cleaning, alkaline etching, acid deoxidizing, fluoride etching, and acid deoxidizing.
2. *Anodizing process.* The anodizing process that produced the best result used 26 percent sulfuric acid electrolyte containing glycerol, lactic acid, and titanium ammonium lactate. While the electrolyte at low anodic film thickness (.0001 inch–.00012 inch) gave absolute reflectance values between 70 and 80 percent, the corrosion resistant requirements of 1000 hours salt spray could not be

met at this thickness. An anodic film thickness of .0008 inch to .0010 inch was necessary to meet the corrosion requirements; however, absolute reflectance values at this thickness were in only the mid-forty to low fifty percent range.

3. *Pigmentation.* The best pigmentation results were obtained with the induced precipitation of lead sulfate from a complexed acetate solution with soluble barium, strontium, or calcium salts. The lead sulfate is dissolved in an acetic acid solution of ammonium acetate, and when the anodic film containing a soluble barium ion such as the acetate is immersed, a dense fine precipitate is formed. This precipitation proceeds slowly but steadily and impregnates deeply.
4. *Sealing.* The corrosion resistance of the anodic film was increased by a further sealing treatment in a polyorganosiloxane after boiling water sealing. The polyorganosiloxane provides such a good paint base that even after 1250 hours of exposure in the salt spray, the surface can be painted with the NASA white enamel with excellent results.

### Notes:

1. Another sealing material based upon a benzyl alcohol solution of fluorochemical surfactants and carboxylic acids gave excellent results in salt spray testing.
2. Neither the polyorganosiloxane seal nor the fluorochemical seal was affected by welding at a distance of one inch from the center of the bead. Both materials materially increased the dielectric breakdown voltage of the anodic film, with the siloxane being better in this respect.

(continued overleaf)

3. Documentation is available from:

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**Patent status:**

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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